I think I want a CMAQ project… Don't I?

Maybe, but there are a few things to keep in mind about the CMAQ program before you decide to submit an application.

CMAQ is a Federal-Aid program… this means that all provisions under the Federal-Aid Highway Program must be followed. These provisions are laid out at the following link - http://www.fhwa.dot.gov/reports/financingfederalaid/procs.htm. The follow information includes some of the highlights.

- CMAQ is a "reimbursement" program, rather than a "cash up-front" program. This means that you must be able to outlay the total funding needed for the approved CMAQ project up front and that NCDOT will reimburse you based on eligible expenses as they are incurred.

- In most cases, CMAQ projects require a local match of at least 20%. Local match funding **cannot** be derived from in-kind services. It must be derived from the following sources:

    - State and/or Local governments' funds;
    - Private contributions;
    - Credit for donated private property or land lawfully obtained by the State or Local government without the use of Federal funds;
    - Federal land management agency funds may be used toward the non-Federal share of any Federal-aid highway project the Federal share of which is funded under title 23 or chapter 53 of title 49; and
    - Federal Lands Highway Program funds, for Federal-aid projects that provide access to or within Federal or Indian lands.

- CMAQ funds may not be distributed directly to a private or non-profit entity, so a public sector partner is required for any proposed project.

- CMAQ funds for any individual fiscal year must be used within four-years – for example, if you are approved funding on October 1, 2010, then you have until September 30, 2014 to utilize this funding. Any portion of the funding not used by this date would no longer be available for your use.

- CMAQ funding **can** be awarded for non-construction or non-implementation activities such as planning, design and right of way acquisition. If desired, funding for these activities should be included in the CMAQ application.

<u>Other information that you should keep in mind…</u>

- The original CMAQ award cannot be modified unless the additional amount of funding needed is available to your MPO/RPO **and** the MPO/RPO endorses the use of these funds for your particular project.

- While the CMAQ application does allow you to specify the desired year for project implementation, NCDOT cannot guarantee that approved projects will be scheduled as such. NCDOT will make every effort to schedule projects as requested, but things like balancing the TIP and cash flow limitation may prevent this.

So I was awarded a CMAQ project… now what?

The process between having a project included in the STIP and actually beginning the project involves many steps.

NCDOT and FHWA have developed a "Project Manager's Guidebook" for CMAQ projects. This document lays out all the steps involved in undertaking a CMAQ project from the initial project award to the project close-out. It is available on the Transportation Planning Branch website – http://www.ncdot.org/doh/preconstruct/tpb/services/air.html. The following provides a quick synopsis of the major steps involved.

- **Required Local Agreement**
  An agreement between NCDOT and the Local Project Sponsor is required for most projects. NCDOT will develop this agreement prior to the start of the scheduled Federal fiscal in which the CMAQ project is first scheduled. This agreement outlines the requirements for the Local Project Sponsor and the process for the reimbursement of eligible expenses.

If the local project sponsor is an urbanized transit agency, the CMAQ funding can usually be flexed from FHWA to FTA… and a local agreement is no longer required!

- **Funding Authorizations - Preliminary Engineering, Right of Way Acquisition & Construction**
  Funding authorization must be obtained from FHWA before any activities can begin for any phase of funding. NCDOT requests funding authorization from FHWA and then issues a notice to proceed to the Local Project Sponsor once that authorization is granted**. Any expenses incurred prior to receiving the notice to proceed cannot be reimbursed!**

  Construction authorization requires the completion of the right of way certification, an approved environmental document (not more than one year old) and the final plans, specifications and estimates. NCDOT will not request construction authorization from FHWA until all these items have been received.

Here's a helpful hint – be sure to include funding needed for PE in your request! This ensures that you will have sufficient funds to implement all phases of your project!

Funding authorization is not an immediate request. The NCDOT project manager must request authorization from the NCDOT Project Management Unit (PMU). The PMU then works with the Federal Funds Management Unit to obtain authorization through the

FHWA Fiscal Management Information System (FMIS). **This process has been known to take several weeks!**

- **Environmental Documentation**
  The National Environmental Policy Act of 1969 (NEPA) requires an environmental assessment for all Federal activities – CMAQ included. There are several different types of environmental assessment documents, but in most cases a Categorical Exclusion (CE) can be completed for CMAQ projects since it's assumed that the project will not involve significant impacts.

  Ideally, the CE should be approved before the local planning sponsor incurs reimbursable costs in order to protect the reimbursement eligibility. For example, if design costs are incurred but the environmental documentation discovers an issue that prevents the project from being completed, then the local planning sponsor would not be reimbursed for the design expenses already incurred.

- **Consultant & Contractor Acquisition**
  Consultant services can be used for CMAQ projects, usually for the completion of the CE or design. Contractor services are normally required for construction work. Selection of firms must follow state and federal guidelines. The consultant/contractor solicitation process cannot begin until the appropriate CMAQ funding has been authorized by FHWA and notice to proceed has been issued by NCDOT. The NCDOT External Audit Branch is available to assist with reviewing qualifications and rates of proposed professional services contracts.

- **Project Design**
  In most cases, the Local Project Sponsor will need to retain a consultant to develop the construction plans, following the above guidelines. All design plans must be consistent with Federal and State standards. Projects that will involve construction within the state highway system right of way will require an encroachment agreement – the Local Project Sponsor is responsible for coordinating with the appropriate NCDOT Highway Division to obtain this agreement.

- **Right of Way Acquisition**
  CMAQ funding can be provided for the acquisition of right of way (ROW) needed to implement an approved project. This funding should be included as part of the overall project cost in the application.

  ROW acquisition for Federally-funded projects is subject to the Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act) regarding acquisition procedures and relocation assistance. **It is imperative that the fund recipient be familiar with this Act.**

- **Right of Way Certification**
  The authorization of construction funding requires the existence of certifiable ROW. ROW certifications are coordinated through the NCDOT Division ROW Agents and the Local Project Sponsor is responsible for coordinating with the appropriate agent.

I have no idea how to calculate emissions benefits!

While NCDOT has no guidance at this time on how to calculate emissions, we have pulled some Federal course info and example calculations for your information.

NCDOT and NCDAQ hosted the FHWA course "Air Quality Analysis Methodologies for Transportation Control Measures" in Raleigh in March 2009. The course presentation, which includes methodologies for estimating emissions for several different types of improvements, is posted on the TPB Website.

FHWA held a CMAQ webinar in April 2007 which included information on estimating emissions for diesel-idling projects. The webinar material is posted on the TPB website.

Both of these files can be found by accessing the following link and scrolling to the bottom of the page:

http://www.ncdot.org/doh/preconstruct/tpb/services/air.html

Here are sample calculations for various types of CMAQ-eligible improvements, taken from actual projects across the United States (source - *SAFETEA-LU 1808: CMAQ Evaluation and Assessment - Phase I Final Report*). This report includes more projects than are actually represented here, so be sure to check it out online -

http://www.fhwa.dot.gov/environment/cmaqpgs/safetealu1808/appendix_c/index.htm

Traffic flow improvements – Signalization

Southeast Michigan Council of Governments, Macomb County, Michigan
Signal Timing along Ryan Rd. 8 Mile to 23 Mile

Coordination of traffic signals along Ryan Rd. from 8 mile to 23 mile in Warren, Sterling Heights, and Shelby Township in Michigan. As a result of this project, vehicle travel speeds are expected to increase 4 mph during both peak and off-peak periods.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA
Δ VMT	NA
Δ Speed	+ 4 mph
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

- Miles of urban minor arterial affected: 15 miles
- Daily, 2-way traffic volume = 23,519 vehicles with 40% of travel occurring in peak periods.
  - Peak VMT = 15 miles * 23,519 vehicles * 0.4 = 141,114 miles
  - Off Peak VMT = 15 miles * 23,519 vehicles * 0.6 = 211,671 miles
- Travel Speeds before project are 31 mph in peak, and 41 mph in off-peak.
- Travel Speeds after project are 35 mph in peak, and 45 mph in off-peak.

Emissions – Methodologies / Assumptions

Δ VOC	- 40.076 kg/day
Δ NOx	NA

- Emissions reductions calculated using Mobile 5a running

Δ CO	NA	emissions factors (g/mile) for VOC at the following speeds: o Peak: 31 mph: VOC = 1.84335 mph: VOC = 1.697 o Off Peak: 41 mph: VOC = 1.52645 mph: VOC = 1.434 • Calculate daily emissions reduced = (change in peak emissions * Peak VMT) + (change in off-peak emissions * Off-peak VMT) • VOC Emissions = ((1.697 - 1.843) * 141,114 miles) + ((1.434 - 1.526) * 211,671 miles) / 1,000 = - 40.076 kg/day
Δ PM_{10}	NA	
Δ $PM_{2.5}$	NA	
Δ Total	- 40.076 kg/day	

Traffic flow improvements – Signalization

Capital Regional Planning Commission, Baton Rouge, Louisiana
Continuous Flow Intersection at Airline and Sherwood Forest Blvd.

Modification of an intersection Airline Highway @ Sherwood Forest Blvd. in order to increase traffic flow and reduce congestion and delay using an innovative intersection improvement concept called continuous flow intersection (CFI). This concept eliminates volume build-up due to the left-turn cycle of the traffic signals by moving the left-turn out of the main intersection, thus allowing through-traffic and left-turning traffic to move through the intersection at the same time. The improvements will reduce total traffic delay by 3 hours during both the morning and evening peak hours. The improvements will also enhance traffic flow and reduce emissions during off-peak times, but the benefit will be greatest during peak hours.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA
Δ VMT	NA
Δ Speed	NA
Δ Delay	- 388 vehicle-hours/hour
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

- Miles of urban minor arterial affected: 15 miles
- Daily, 2-way traffic volume = 23,519 vehicles with 40% of travel occurring in peak periods.
  - o Peak VMT = 15 miles * 23,519 vehicles * 0.4 = 141,114 miles
  - o Off Peak VMT = 15 miles * 23,519 vehicles * 0.6 = 211,671 miles
- Travel Speeds before project are 31 mph in peak, and 41 mph in off-peak.
- Travel Speeds after project are 35 mph in peak, and 45 mph in off-peak.

Emissions – Methodologies / Assumptions

Δ VOC	- 40.076 kg/day
Δ NOx	NA
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	- 40.076 kg/day

- Emissions reductions calculated from changes in delay.
- Emissions factors were developed using MOBILE6, using 2.5 Mph speed, and converted into idle emissions factors.
- Emissions factor for VOC = 10.35 g/mi
- Emissions factor for NOX= 2.67 g/mi
- Emissions reduction = Delay in vehicle-hours/hour * Emissions Factor * 2.5 (conversion of gm/mi to gm/hr) * 2 hours per day (calculated for 2-hour Am peak and 2-hour Pm peak separately, and summed)

Traffic flow improvements – Signalization

Knoxville Urbanized Area MPO, Knoxville, Tennessee

Signal Timing on SR-169 Cedar Bluff to College St.

Traffic signal timing and synchronization of traffic signals along Middlebrook Park from Cedar Bluff St. to College St.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA
Δ VMT	NA
Δ Speed	+ 4 mph
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

- Daily VMT = 25,935 average daily traffic x 9.47 mile corridor length = 245,065 VMT on corridor.
- An average improvement in speed/travel of 12% for traffic signal upgrades of this type is noted in the publication "A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility" from ITE.
- Average speed increased from 34 mph to 38 mph.

Emissions – Methodologies / Assumptions

Δ VOC	14.969 kg/day
Δ NOx	+ 2.206 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ TOTAL	- 12.763 kg/day

Emissions factors for before project implementation and after project implementation based on MOBILE6 and average speeds of 34 mph and 38 mph, respectively.

Emissions reduction = VMT x (Emissions Factor before project Emissions Factor after project)

- VOC Emissions reduction = 245,065 VMT x (1.883 1.826) / 1000 = 14.969 kg/day
- NOx Emissions reduction = 245,065 x (1.847 1.856) / 1000 = - 2.206 kg/day

Traffic flow improvements – Signalization

Lexington Area MPO, Kentucky

Installation of Reversible Lanes on Nicholasville Road (US-27)

Create third northbound traffic lane for the morning peak period using reversible lane controls on Nicholasville Road (US 27) from Southpoint Drive to Tiverton Way. By taking advantage of unutilized median space and low early morning left-turning volumes at the intersection, reversible lane control methods can be used to reassign one of the left-turn lanes as a through-lane during the high-volume period. The project will also require the expansion of the computerized traffic signal system to add new reversible lane signals. This project will improve the traffic flow on Nicholasville Road, which will in turn reduce traffic congestion, accidents, and delays, and ultimately improve air quality.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA
Δ VMT	NA
Δ Speed	NA
Δ Delay	- 63 vehicle-hours

Delay (vehicle-hours):

2006 No-build = 362 vehicle-hours of delay
2006 Build = 299 vehicle-hours of delay

Δ SOV	NA	Change in delay due to project implementation = 362 - 299 = 63
Δ CP/VP	NA	vehicle-hours = 17% reduction in delay
Δ Transit	NA	
Δ Walk	NA	Reduction in delay determined by the Synchro model output, based
Δ Bike	NA	on a one-hour simulation. These one hour peak delay reductions, per day, were used to determine an average delay for two hours of peak travel reductions.

Emissions – Methodologies / Assumptions

Δ VOC	- 2.889 kg/day
Δ NOx	- 1.089 kg/day
Δ CO	- 44.95 kg/day
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	- 4 kg/day

The delay reductions were used to calculate the emissions savings using emissions factors provided by US EPA Office of Transportation and Air Quality.

Reduction in delay ***** average of vehicle mix for kg/min per CO, NOx, VOC ***** 255 days per year

Traffic flow improvements – Signalization

Capital District Transportation Committee, Albany, New York

Construction of a Two Lane Roundabout at Fuller and Washington

Construction of a two-lane roundabout at the intersection of Washington Avenue and Fuller Road (County Road 156) in the City of Albany, Albany County. The intersection currently operates under the control of a traffic signal. The roundabout intersection will include the construction of sidewalks.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA	8,670 average traffic volumes for Year 2009 were calculated using
Δ VMT	NA	the CDTC STEP Model. The CDTC STEP Model forecast was validated
Δ Speed	+ 14 mph	using a 1999 intersection count and used to calculate seconds of
Δ Delay	- 6.5 sec/veh.	delay for approach vehicles with the existing signalized intersection.
Δ SOV	NA	The RODEL Roundabout Capacity Model was used to conduct an
Δ CP/VP	NA	analysis of the Washington Avenue/Fuller Road intersection and was
Δ Transit	NA	used to calculate seconds of delay for approach vehicles under the
Δ Walk	NA	new, roundabout build scenario. (11.5 sec avg "No Build" delay 5 sec
Δ Bike	NA	avg "New Roundabout" delay = 6.5 sec avg change in delay.

Washington Ave and Fuller Rd Roundabout Capacity RODEL Analysis 1999 counts

Leg	Flow (veh/hr)	Avg Delay	Avg Queue	Max Delay	Max Queue
Washington Ave EB	1212	5 sec	2	7 sec	2
Fuller Rd NB	591	5 sec	1	7 sec	1
Washington Ave WB	1368	6 sec	2	9 sec	3
Fuller Rd SB	885	4 sec	1	6 sec	1

Washington Ave and Fuller Rd Roundabout Capacity RODEL Analysis 1999 counts increased to 2009 total approach volume of CDTC STEP Model

Leg	Flow (veh/hr)	Avg Delay	Avg Queue	Max Delay	Max Queue
Washington Ave EB	1454	14 sec	5	25 sec	9
Fuller Rd NB	709	10 sec	2	18 sec	3
Washington Ave WB	1642	16 sec	7	30 sec	13
Fuller Rd SB	1062	6 sec	2	11 sec	3

VMT was estimated using a quarter mile approach for each leg of the intersection. Speeds were calculated over that same distance as 15

mph under existing conditions and 29 mph with the roundabout.

The STEP model was also used to calculate seconds of delay for vehicles with the existing signalized intersection for the no-build scenario. The NYSDOT Roundabout Design Unit conducted an analysis of the proposed improvement using the RODEL Roundabout Capacity model to calculate seconds of delay for approach vehicles under the build scenario.

Emissions – Methodologies / Assumptions

Δ VOC	- 24.17 kg/day
Δ NOx	- 1.94 kg/day
Δ CO	- 24.17 kg/day
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	- 26.11 kg/day

The NYSDOT software package **CMAQtraq** was used to estimate emissions, using the "Traffic Flow Improvements" module. Effects were calculated for 250 days/year with the following emissions factors (g/mile):

CO = Before: 18.01 After: 16.02
VOC = Before: 1.01 After: 0.71
NOx = Before: 0.95 After: 0.79

Traffic flow improvements – Freeway Management

Capital Regional Planning Commission, Baton Rouge, Louisiana
ITS on I-10 from Acadian St. to Highland Blvd.

Continue phase II of the Baton Rouge ITS plan, and include installing freeway ITS components along I-10 from Acadian St. to Highland Blvd. to assist with incident detection and response, motorist assistance, and surveillance.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	NA
Δ VMT	NA
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

The overall level of VMT and vehicle trips is not assumed to be affected. Emissions reductions will occur through a reduction in nonrecurring congestion.

Emissions – Methodologies / Assumptions

Δ VOC	- 189.601 kg/day
Δ NOx	- 488.972 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	-678.573 kg/day

Emissions factors for baton rouge based on MOBILE Model; assumed running speed of 40 MPH. Emissions reductions were applied to the length of I-10, as follows:

1. Freeway emissions = freeway VMT (from Tranplan model) ***** Emissions factor (from MOBILE in grams/mile)
2. Freeway emissions due to nonrecurring congestion = freeway emissions ***** 0.049 (assumes 4.9% of freeway emissions are caused by nonrecurring congestion using data from Lindley, J. A. "Urban Freeway Congestion: Quantification of the Problem

and Effectiveness of Potential Solutions." 1987).

Emissions reduced due to program = freeway emissions due to nonrecurring congestion * effectiveness factor. Effectiveness factor assumed to be 0.90, based on effectiveness rate of 50% for Incident Detection and Response, 25% for Motorist Assistance, and 15% for Surveillance.

Shared Ride Programs - Regional Ridesharing

Birmingham Regional Planning Commission, Birmingham, AL
CommuteSmart Commuter Services Program Operations

Continuing operation of the CommuteSmart Commuter Services Program in Birmingham, Alabama. The program includes a ridesharing database, a vanpool program with up to 34 vans in 2007 and a carpool program.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	- 311.78 /day
Δ VMT	- 9,469.98 /day
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	- 76 carpool trips/day
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

- Number of Vanpool vans = 34 vehicles
- Average van occupancy = 9.64 people per van
- Estimated percent of vanpoolers previously took carpools = 9%
- Annual Van trips = 17,380 trips/year
- Annual Van miles = 1,078,692 miles/year
- Annual Passenger Trips = 107,303 trips/year
- Annual Passenger Miles = 4,241,282 miles/year
- Passenger trip length per trip (one way) = 39.53 miles per trip
- Average auto occupancy = 1.09 people per car
- Number of days project affected per year = 260 days per year

- Daily Vehicle Trip Reduction: (107,303 passenger trips / 1.09 average auto occupancy 17,380 van trips) / 260 days/year = 311.78 daily vehicle trip reduction.
- Of those trips, carpool trip reduction = 76 trips/day.

- VMT reduction (taking into account the van miles): 4,241,282 passenger miles / 1.09 auto occupancy x ((1 9% percent of vanpoolers previously took carpools) - 1,078,692 van miles) / 260 days/year = 9,469.98 daily VMT.
- Of that VMT reduction, carpool VMT reduction = 188,929 miles/year / 260 days/year = 726.65 daily carpool VMT reduction.

Emissions – Methodologies / Assumptions

Δ VOC	- 10.21 kg/day
Δ NOx	- 11.96 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	- 0.133 kg/day
Δ Total	-22.17 kg/day

Emissions reductions calculated using Mobile6 emissions factors for 2005 at a 35 mph average operating speed.

- Auto HC emissions factor 1.1640 grams/mile
- Auto NOx emissions factor 1.2720 grams/mile
- Van HC emissions factor 1.5630 grams/mile
- Van NOx emissions factor 1.5160 grams/mile

- Auto $PM_{2.5}$ emissions factor, 0.0133 grams/mile
- Van $PM_{2.5}$ emissions factor, 0.0140 grams/mile

Shared Ride Programs – Park and Ride Lot

Baltimore Metropolitan Council, Maryland

Two New 25-Space Lots

Construction of two new park and ride facilities at I-95 interchanges at MD 272 and MD 279. Each park and ride lot will contain 25 parking spaces.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	0
Δ VMT	- 23/day
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

Vehicle trip reduction = 50 parking spaces * 15% utilization rate * 15% new riders = 1.15 vehicle trips reduced per day (zero change in trip starts).

VMT reduction = 1.15 vehicle trips reduced * 20 mile round trip = 23 vehicle miles reduced per day.

Lot utilization rates and the percentage of new riders were determined from surveys at existing park and ride lots.

Emissions – Methodologies / Assumptions

Δ VOC	- 0.012 kg/day
Δ NOx	- 0.058 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	-0.070 kg/day

Emissions reductions were calculated by multiplying VMT reduction by per-mile emissions factors. Emissions were calculated based on 1999 emissions factors developed for the Baltimore region based on the MOBILE model. Assumed running speed is 60 mph.

- VOC Emissions Factor: 0.552 g/mi
- NOx Emissions Factor: 2.559 g/mi

Travel Demand Management

Denver Regional COG, Denver, Colorado

Coordinate Telework Program

Free telework consulting service for employers in the Denver metro area. The DRCOG's RideArrangers program provides consultations, design, implementation, evaluation, and training session assistance for interested employers.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	- 16,031 /week
Δ VMT	- 223,413 /week
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

Vehicle trip reduction = 87,127 employees at companies with a telework program x 0.05 percentage of employees that telework x 1.84 average days per week that employees telework instead of commute x 2 = 16,031 vehicle trips reduced weekly.

VMT reduction = 87,127 employees at companies with a telework program * 0.05 percentage of employees that telework * 26 mile average trip distance * 1.84 average days per week that employees telework instead of commuting = 223,413 weekly VMT reduction.

Emissions – Methodologies / Assumptions

Δ VOC	- 2.0 kg/day	Emissions reductions calculated using 2006 MOBILE6 factors.
Δ NOx	- 2.0 kg/day	
Δ CO	- 14.0 kg/day	
Δ PM_{10}	NA	
Δ $PM_{2.5}$	NA	
Δ Total	- 4 kg/day	

Travel Demand Management

Metropolitan Washington COG MPO, District of Columbia

Guaranteed Ride Home (GRH)

This program is an added incentive to employers and employees participating in the Commuter Connections program. It provides the security of a ride home in the event of an emergency, unscheduled overtime, or early leave departure. The program provides up to four free rides home per year in a taxi or rental car for commuters that use alternative modes of transportation at least two days per week. Since a sizeable portion of GFH applicants are already ridesharing before they apply for GFH benefits, the most common benefit of GRH may be the continuation and extension of existing ridesharing arrangement. The transportation and emissions impacts of the GRH program were measured through data from a survey conducted in the spring of 2004, which polled 1,000 commuters who had registered for GRH at some point between 2001 and 2004. The survey asked detailed questions regarding commute patterns, the permanence of mode changes, and the overall importance of the program to commuters' decisions to start/continue use of alternative modes.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	- 12,350 /day	Based on surveys, new participants were grouped into those who work and live within the DC Metropolitan Statistical area (11,574) and those who work within the MSA but live outside (2,245). For those living within the MSA, assume 0.91 vehicle trips reduced per new participant and a 28.2 mile one-way trip length. For participants living outside the MSA, assume a 0.81 vehicle trip reduction per new participant and a 28.2 mile one-way trip length within the MSA.
Δ VMT	- 348,283/day	
Δ Speed	NA	
Δ Delay	NA	
Δ SOV	NA	
Δ CP/VP	NA	
Δ Transit	NA	
Δ Walk	NA	Vehicle trips reduction = (11,574 participants ***** 0.91 VTR per new participant) + (2,245 participants ***** 0.81 VTR per new participant) = 12,350 trips reduced/day.
Δ Bike	NA	
		VMT reduction = 12,350 VTR ***** 28.2 miles one-way trip length = 348,283 miles reduced per day.

Emissions – Methodologies / Assumptions

Δ VOC	- 95.25 kg/day	Emissions reductions calculated using Mobile6.
Δ NOx	- 216.82kg/day	
Δ CO	- 14.0 kg/day	
Δ PM_{10}	NA	
Δ $PM_{2.5}$	NA	
Δ Total	- 312 kg/day	

Bicycle/Pedestrian Improvements

Southeastern Regional Planning & Economic Development District, Swansea, Massachusetts
8.3 mile Swansea Bikeway Facility

The Swansea bike path project forms an essential part of the future link between the Taunton River Trail and the East Bay Trail in Rhode Island. The proposed route along Old Warren Rd. is primarily a bike facility located on streets, with a few bicycle path segments.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	- 212 /day
Δ VMT	- 613/day
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	+ 1.0 %

- Work trips = 3,929 workers in service area x 1.0% bicycle commuting mode share = 39 one-way trips. Non-work trips = 67 one-way trips
- Daily vehicle trips = (39 one-way work trips + 67 one-way non-work trips) x 2 = 212 daily trips.
- Assume average trip is half the length of the bike facility.
- Daily VMT reduction = (2 x 39 one-way trips) + (2 x 67 one-way trips) ***** (0.5 x 8.3 miles facility length) = 633 daily VMT reduction.
- Work trips were calculated by estimating a 1 mile service area radius around the length of the 8.3 mile facility and then calculating the proportion of the total land of the community, the total population of the community, the number of households in the community, and the number of workers per household that would be served.
- The Bicycle Commuting Mode Share was estimated using the population density for the service area and a "Percent Bike Use for Commuting" table published by MassHighway Planning Department.

Emissions – Methodologies / Assumptions

Δ VOC	- 0.5 kg/day
Δ NOx	- 1.1 kg/day
Δ CO	- 3.0 kg/day
Δ PM_{10}	QA
Δ $PM_{2.5}$	NA
Δ Total	-1.6 kg/day

- Emissions factor calculated from MOBILE5A, using 35 mph average commuter travel speed.
- VOC emissions factor = 0.819 g/mile
- NOx emissions factor = 1.672 g/mile
- Summer CO emissions factor = 5.096 g/mile

Transit Improvements - New Rail Services

Greater Bridgeport Regional Planning Agency, Fairfield, Connecticut
Construct Rail Station Platforms and Bridge

Construction of a new commuter rail station, the Fairfield Metro-North Railroad station. The project will serve the residents of Fairfield, Connecticut, including students of Fairfield University as well as nearby areas such as Black Rock within the city of Bridgeport via the New Haven Line. The station will be a joint development, with a developer providing parking spaces and the State providing the railroad platform and an access roadway.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	0
Δ VMT	- 15,792 /day

- Assumes 1,200 new parking spaces for rail patrons.

Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	+ 1.0 %

- Assumes 1/3 of the total ridership would be from new riders (based on rail ridership forecasts prepared by the Department for the new West Haven/Orange Rail Station Study).
- Roundtrip distances based on data from the Department's 2000 AM Peak Rail Survey. Of the Fairfield resident users, 21% destined to points within Connecticut, 79% destined to New York.
- Vehicle trip reduction =1,200 parking spaces x 1/3 new ridership utilization = 400 daily round trips reduced (no trip starts reduced).
- VMT reduction = (400 vehicle trips reduced x 21% x 30 miles) + (400 vehicle trips reduced x 79% x 42 miles) = 2520 + 13,272 = 15,792 VMT reduced daily.

Emissions – Methodologies / Assumptions

Δ VOC	- 6.0 kg/day
Δ NOx	- 6.0 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	- 1.0 kg/day
Δ Total	- 12.0 kg/day

Emissions reductions calculated using Mobile6.2 with an average speed of 50 mph.

- *Trips within Connecticut (30 miles roundtrip):*
  Daily emissions reduction = VMT x emissions factor.

- *New York-destined trips (42 miles roundtrip):*
  Daily emissions reduction = VMT x emissions factor.

Transit Improvements - New Bus Services

Milwaukee-Racine MPO, Racine, Wisconsin

City of Racine New Sunday Bus Service

Expand the current bus service in the City of Racine by instituting Sunday service hours. It is expected that service would run from 8 AM to 4 PM, and would be provided over eight routes within the City of Racine on an hourly basis, using nine buses. Morning trips would focus on church-related activities and afternoon trips on shopping and social activities.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	- 72/day (Sunday only)
Δ VMT	- 15,792 /day
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	+ 72/day (Sunday)
Δ Walk	NA
Δ Bike	+ 1.0 %

- Assumes 1,200 new parking spaces for rail patrons.
- Assumes 1/3 of the total ridership would be from new riders (based on rail ridership forecasts prepared by the Department for the new West Haven/Orange Rail Station Study).
- Roundtrip distances based on data from the Department's 2000 AM Peak Rail Survey. Of the Fairfield resident users, 21% destined to points within Connecticut, 79% destined to New York.
- Vehicle trip reduction =1,200 parking spaces x 1/3 new ridership utilization = 400 daily round trips reduced (no trip starts reduced).
- VMT reduction = (400 vehicle trips reduced x 21% x 30 miles) + (400 vehicle trips reduced x 79% x 42 miles) = 2520 + 13,272 = 15,792 VMT reduced daily.

Emissions – Methodologies / Assumptions

Δ VOC	- 2.9 kg/day
Δ NOx	- 3.2 kg/day
Δ CO	NA
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	-6.1 kg/day

- Emissions reductions were calculated by multiplying VMT reduction by per-mile emissions factors for a typical summer day, based on MOBILE.

Technology Improvements – Conventional Bus Replacement

Ohio-Kentucky-Indiana Regional COG, Southwest Ohio

61 Replacement Buses

Purchase of 61 new 40-foot coaches to replace 15-year old ones. The new coaches will reduce air pollution because they are manufactured to adhere to much stricter air quality standards than the coaches they replace. The coaches will be equipped with security cameras and bike racks to increase security and provide multimodal connectability. The coaches are lift-equipped for disability accessibility. They also come equipped with ITS equipment and METRO, which are connected to ARTIMIS, allowing the transfer of information on highways to aid in congestion relief.

Travel Impacts – Methodologies / Assumptions

Δ Vehicle trips	
Δ VMT	+ 45 bus-miles/day
Δ Speed	NA
Δ Delay	NA
Δ SOV	NA
Δ CP/VP	NA
Δ Transit	NA
Δ Walk	NA
Δ Bike	NA

Methodology does not account for any reduction in person motor vehicle travel, simply the replacement of existing buses. The methodology actually assumes an increase in VMT from the buses, as the new buses travel more.

Average daily VMT for old buses = 77 VMT is the default value for 15-year old urban transit buses using MOBILE 6.2.

- Average daily VMT for new buses = 122 VMT is the default value for 1-year old urban transit buses using MOBILE 6.2.

Emissions – Methodologies / Assumptions

Δ VOC	-9.639 kg/day
Δ NOx	-35.530 kg/day
Δ CO	-11.639 kg/day
Δ PM_{10}	NA
Δ $PM_{2.5}$	NA
Δ Total	NA

Calculation used MOBILE 6.2 emissions factors for 15-year old and 1-year old urban transit buses operating on local streets.

- Emissions factors for 15-year old urban transit buses:
  - VOC = 2.74 g/mile; NOx = 24.20 g/mile; CO = 12.61 g/mile
- Emissions factors for 1-year old urban transit buses
  - VOC = 0.44 g/mile; NOx = 10.59 g/mile; CO = 6.44 g/mile

Bus emissions are calculated by multiplying VMT by emissions factor. Total old bus emissions Total new bus emissions = Total emissions reduction

- VOC: 12934 3295 = 9.639 kg/day
- CO: 59499 47860 = 11.639 kg/day
- NOX: 114234 78704 = 35.530 kg/day